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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/710,257	06/29/2004	Ravikumar Ramachandran	FIS920040102US1	4256
32074	7590	10/03/2005	EXAMINER	
INTERNATIONAL BUSINESS MACHINES CORPORATION			DUONG, KHANH B	
DEPT. 18G			ART UNIT	
BLDG. 300-482			PAPER NUMBER	
2070 ROUTE 52			2822	
HOPEWELL JUNCTION, NY 12533			DATE MAILED: 10/03/2005	

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/710,257

Applicant(s)

RAMACHANDRAN ET AL.

Examiner

Khanh B. Duong

Art Unit

2822

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 29 June 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) 11-20 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-10 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 29 June 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_

- 4) ☒ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. this paper.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

### DETAILED ACTION

This Office Action is in response to the filing of the application on June 29, 2004.

Accordingly, claims 1-20 are pending.

#### *Election/Restrictions*

Restriction to one of the following inventions is required under 35 U.S.C. 121:

- I. Claims 1-10, drawn to a method of forming a semiconductor device, classified in class 438, subclass 287.
- II. Claims 11-20, drawn to a semiconductor device (product-by-process), classified in class 257, subclass 288.

The inventions are distinct, each from the other because of the following reasons:

Inventions I and II are related as process of making and product made. The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make other and materially different product or (2) that the product as claimed can be made by another and materially different process (MPEP § 806.05(f)). In the instant case, the silicon nitride layer can alternatively be formed by atomic layer deposition (ALD) instead of dual-frequency PECVD.

Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.

Because these inventions are distinct for the reasons given above and the search required for Group I is not required for Group II, restriction for examination purposes as indicated is proper.

Because these inventions are distinct for the reasons given above and have acquired a separate status in the art because of their recognized divergent subject matter, restriction for examination purposes as indicated is proper.

During a telephone conversation with Todd Li on September 23, 2005, a provisional election was made with traverse to prosecute the invention of Group I, claims 1-10. Affirmation of this election must be made by applicant in replying to this Office action. Claims 11-20 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

### *Specification*

The disclosure is objected to because of the following informalities: paragraph [0005], line 3, "FIG. 2" should be --FIG. 1--.

Appropriate correction is required.

The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

The following title is suggested: METHOD OF FORMING SIDEWALL SPACER  
USING DUAL-FREQUENCY PLASMA ENHANCED CVD.

***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

**Claims 1-10 are rejected under 35 U.S.C. 102(e) as being anticipated by Jung et al.**

**(U.S. 2005/0170104 A1).**

Re claim 1, Jung et al. ("Jung") discloses in FIG. 1B [see TABLES II & III; page 7, paragraph 0087 to page 8, paragraph 0095] a method of forming a PFET device comprising the steps: providing a substrate 102 having at least one gate stack 110; depositing a silicon nitride layer 118 by means of a dual-frequency plasma enhanced CVD process, the CVD process comprising a temperature in the range 375°C to 550°C (including 400°C to 550°C); forming a spacer on said at least one gate stack 110 from said silicon nitride layer 118; and forming a PFET device 100 comprising said at least one gate stack 110 having said spacer.

Re claim 2, Jung discloses in TABLE II said dual-frequency plasma enhanced CVD process further comprises a pressure in the range 2 Torr to about 15 Torr (including 2 Torr to 5 Torr).

Re claim 3, Jung discloses in TABLE II said dual-frequency plasma enhanced CVD process further comprises a low frequency power in the range 0 W to about 100 W (including 0 W to 50 W).

Re claim 4, Jung discloses in TABLE II said dual-frequency plasma enhanced CVD process further comprises a high frequency power in the range 10 W to about 200 W (including 90 W to 110 W).

Re claim 5, Jung discloses in TABLE II said dual-frequency plasma enhanced CVD process further comprises precursor gases of silane, ammonia and nitrogen at flow rates in the ratio in the range of 40-350:1,000-5,000:2,000-20,000 (including 240:3200:4000 sccm).

Re claim 6, Jung discloses in TABLE II said dual-frequency plasma enhanced CVD process further comprises a temperature of 375°C to 550°C (including 480°C).

Re claim 7, Jung discloses in TABLE II said dual-frequency plasma enhanced CVD process further comprises a pressure of 2 Torr to about 15 Torr (including 2.5 Torr).

Re claim 8, Jung discloses in TABLE II said dual-frequency plasma enhanced CVD process further comprises a high frequency power of about 10 W to 200 W (including 100 W) and a low frequency power of about 0 W to 100 W (including 40 W).

Re claims 9 and 10, see discussions above regarding claims 1-8.

### ***Conclusion***

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.


The following prior arts disclose relevant teachings regarding methods of forming silicon nitride by dual frequency PECVD: U.S. Patents to Yau '185, Westendorp '036, and Cheng '407.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Khanh B. Duong whose telephone number is (571) 272-1836.

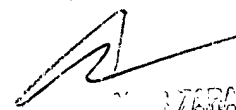
The examiner can normally be reached on 10:00-6:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian can be reached on (571) 272-1852. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



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